

Hemipelvectomy: a changing perspective for a rare procedure

Christopher R. Baliski, MD;* Norman S. Schachar, MD;† J. Gregory McKinnon, MD;† Gavin C. Stuart, MD;‡ Walley J. Temple, MD†

Objective: To compare the prognosis of patients undergoing a hemipelvectomy (HP) in the treatment of pelvic sarcomas and carcinomas and to review the morbidity and mortality associated with HP. **Design:** Retrospective chart review. **Setting:** The Foothills Hospital, University of Calgary, Calgary, Alberta. **Patients:** Thirteen patients with clinically and radiographically isolated malignancies involving the bony pelvis and adjacent structures. **Interventions:** Patients were treated with either an external HP (9 patients) or internal HP (4) in 1983–2001. **Outcome measures:** Survival and recurrence rates for patients in 2 histopathologic groups (sarcoma v. carcinoma); morbidity and mortality associated with HP. **Results:** Hemipelvectomy was performed for 7 sarcomas (4 primary bone and 3 soft tissue) and 6 carcinomas (5 genital tract and 1 unknown primary). Seven of the 9 external HPs involved composite resection of other pelvic structures, including other pelvic viscera (3 patients), sacrum (3) and portions of lumbar vertebrae and nerves (1). There were no additional resections among the 4 internal HPs, but 3 patients had allograft reconstruction. Length of stay averaged 30 days (range 14–70 d). At least 1 complication occurred in 10 of 13 cases. The most common complication was flap necrosis occurring in 5 patients (38%). There was 1 perioperative death (8%). The survival of patients treated for sarcomas was better than for carcinomas, which were primarily of the genital tract. Only 1 of the patients with a pelvic sarcoma died of disease (86% disease-specific survival), with a median follow-up of 12 months (range 9–108 mo). Of the 7 sarcoma patients 5 were disease-free at last follow-up. One of 6 pelvic carcinoma patients died perioperatively, with another dying of unknown causes 4 months after surgery. Of the 4 remaining patients 3 died of disease, resulting in a median survival of 9 months (range 4–20 mo). Four of 6 patients with pelvic carcinomas developed recurrent disease, none local. **Conclusions:** HP has considerable morbidity but is a viable and potentially curative treatment for patients with pelvic sarcomas. With pelvic carcinomas HP was not curative, but did provide short-term local disease control. Future improvements in imaging techniques and quality-of-life studies may help with patient selection. The role of HP in recurrent carcinoma remains to be determined.

Objectif : Comparer le pronostic des patients qui subissent une hémipelvectomie (HP) comme traitement des sarcomes et des cancers du bassin et analyser la morbidité et la mortalité connexes. **Concept :** Étude rétrospective de dossiers, 1983–2001. **Contexte :** L'Hôpital Foothills, Université de Calgary, Calgary (Alberta). **Patients :** Treize patients chez lesquels on a isolé cliniquement et radiographiquement des tumeurs malignes atteignant l'os du bassin et les structures voisines. **Interventions :** Les patients ont subi une HP externe (9 patients) ou interne (4 patients). **Mesures de résultats :** Taux de survie des patients et de récurrence dans deux groupes histopathologiques (sarcome et cancer); morbidité et mortalité associées à l'hémipelvectomie. **Résultats :** On a procédé à une hémipelvectomie pour exciser 7 sarcomes (4 sarcomes primitifs des os et 3 sarcomes des tissus mous) et 6 cancers (5 du tractus génital et un cancer primitif inconnu). Sept des 9 HP externes ont obligé à pratiquer une résection composée d'autres structures pelviennes, y compris d'autres viscères pelviens (3 patients), du sacrum (3) et de portions des vertèbres et des nerfs lombaires (1). On n'a pas procédé à d'autres résections après les 4 HP

From the *Division of General Surgery, Department of Surgery, St. Paul's Hospital, University of British Columbia, Vancouver, BC, and the †Division of Surgical Oncology, Department of Surgery and the ‡Division of Gynecological Oncology, Department of Oncology, University of Calgary, Calgary, Alta.

Accepted for publication Jan. 14, 2004

Correspondence to: Dr. Christopher R. Baliski, Department of Surgery, St. Paul's Hospital room C302, 1081 Burrard St., Vancouver BC V6Z 1Y6; cbaliski@providencehealth.bc.ca

internes, mais 3 patients ont subi une reconstruction par allogreffe. La durée du séjour s'est établie en moyenne à 30 jours (plage de 14 à 70 jours). Il y a eu au moins une complication dans 10 des 13 cas. La complication la plus courante a été la nécrose du lambeau, qui s'est produite chez cinq patients (38 %). Il y a eu un décès en période périopératoire (8 %). La survie des patients traités contre un sarcome a été meilleure que celle des patients traités contre un cancer, lequel atteignait principalement le tractus génital. Un seul des patients atteints d'un sarcome pelvien est mort de la maladie (survie spécifique à la maladie de 86 %), le suivi médian s'établissant à 12 mois (plage de 9 à 108 mois). Des 7 patients atteints d'un sarcome, 5 étaient libres de maladie au dernier suivi. Un des 6 patients atteints d'un cancer au bassin est mort en période périopératoire, et un autre est mort de causes inconnues 4 mois après l'intervention chirurgicale. Des 4 autres patients, trois sont morts de la maladie, soit une survie médiane de neuf mois (plage de 4 à 20 mois). Chez 4 des 6 patients atteints d'un cancer du bassin, la maladie est réapparue, mais dans aucun cas localement. **Conclusions :** L'hémipectomie entraîne une morbidité importante, mais elle constitue un traitement viable et parfois curatif pour les patients atteints d'un sarcome du bassin. Dans le cas du cancer du bassin, l'hémipectomie n'a pas été curative, mais elle a permis de contrôler localement la maladie pendant une brève période. Les améliorations futures des techniques d'imagerie et des études sur la qualité de vie pourraient faciliter la sélection des patients. Il reste à savoir quel rôle peut jouer l'hémipectomie dans les cas de récurrence du cancer.

Hemipelvectomy (HP) is an uncommon procedure performed in response to a variety of pelvic neoplasms. The most common indication is primary neoplasms of the bony pelvis, but it is used for soft-tissue sarcomas of the pelvis as well. Other less common indications for HP are advanced melanoma, squamous cell carcinoma, renal and bladder cancer, rectal cancer, and even metastatic disease that has gone into the bone.^{1,2}

HP is usually performed in highly specialized tertiary/quaternary medical centres with a comprehensive surgical oncology team. The infrequent indications, technical challenges and attendant morbidity of HP demand this. The University of Calgary is a regional referral centre for patients being assessed for this procedure.

The primary purpose of this study was to review long-term prognosis with reference to clinical/pathologic factors, in order to help determine which patients would benefit most from HP. The morbidity and mortality associated with HP was reviewed as well.

Materials and methods

The medical records of the Foothills Hospital (University of Calgary) were reviewed for patients undergoing HP from 1983 to 2001. An HP was classified as external if the leg was amputa-

ted along with the hemipelvis, whereas an internal HP involved preservation of the leg and major neurovascular structures, with a major resection of the bony pelvis. Information obtained included symptoms; operative procedure, surgical operative time and blood loss; histopathologic examination of the tissue removed and its margins; previous and adjuvant treatment(s); and in-hospital morbidity and mortality. Follow-up data for patients were obtained from the charts of the Southern Alberta Cancer Registry (Tom Baker Cancer Centre) and referring institutions, and also from direct communication with patients. All HPs were performed with curative intent after an extensive metastatic work-up.

Results

Thirteen patients underwent HP during the study period. Their median age was 39 years (range 18–66 yr). The clinical indications for HP were highly variable. Seven patients had primary pelvic sarcomas (4 bone and 3 soft-tissue); the other 6 had carcinomas (5 genital tract and 1 metastatic) involving either the pelvis or major neurovascular structures. The symptoms patients experienced were also varied; all complained of pelvic or leg discomfort, with 10 of 13 patients having severe pain requiring narcotics to manage it. Two patients had fun-

gating groin masses that were not amenable to treatment with radiation. Four complained of leg weakness.

Nine patients underwent an external HP (hindquarter amputation), whereas 4 were treated with an internal hemipelvectomy (Table 1). Seven of 9 external HPs involved composite resections of other pelvic structures, including other pelvic viscera (3 patients), the sacrum (3), and portions of lumbar vertebrae and nerves (1). All internal HPs were restricted to resections of bone only, with 3 patients undergoing allograft reconstruction and 2 requiring total hip arthroplasties. Margins tested positive on pathologic examination in 5 of 13 HPs (38%), with the margins of 2 of the 3 sacrectomies exhibiting tumour. The mean length of the operative procedure was 7 hours, with a mean blood loss of 2.73 L. Median length of stay was 30 days (range, 12 to 70 d).

Ten patients (77%) experienced at least 1 postoperative complication. Five patients (38%) developed skin-flap necrosis, requiring 9 operative procedures for debridement and tissue coverage (1–3 operations per individual). Seven patients developed other in-hospital complications, including cellulitis, prolonged ileus, pneumonia, urinary retention, hip dislocation, intra-abdominal abscess and bowel obstruction. Of the 3 patients who underwent an internal HP and

pelvic allograft, the 2 with sarcomas required readmission and (external) completion HPs for chronic osteomyelitis, with 1 of the 2 also requiring repair of a bladder fistula. One patient died from complications related to bowel obstruction and intra-abdominal sepsis after a combined HP and pelvic exenteration (a perioperative mortality of 8%).

The median follow-up for all patients was 11 months. In addition to 1 perioperative death, 2 patients died of other causes at 4 months and 5 years of follow-up respectively, both free of disease. Four died of disease at a median of 8.5 months (range 4–20 mo). Two patients are alive with disease at 11 and 12 months, 1 of whom has a local recurrence. Four patients are disease-free at a median follow-up period of 60 months (range 9–108 mo; Table 1).

The prognosis for patients with sarcomas of the pelvis was superior to

those with carcinomas (non-sarcomas). At a median follow-up of 12 months, only 1 patient with sarcoma had died of disease, secondary to sarcomatosis, for a disease-specific survival rate of 86%. Another died of other causes 5 years after HP. Six of 7 sarcoma patients were disease-free at last follow-up; the other is alive with locally recurrent disease after 12 months.

For the 6 patients with pelvic carcinomas, outcomes were much worse. One patient died of complications related to postoperative sepsis; another died of unknown causes 4 months after surgery. Three of the 4 other patients died of disease at a median of 9 months (range 8–20 mo). Before their deaths these 3 patients developed recurrent disease: 1 with carcinomatosis, 1 in the contralateral groin and 1 systemic. Only 1 patient with pelvic carcinoma remains alive (11 months after undergoing HP), but with disease in the contralateral groin.

Discussion

Hemipelvectomy is a procedure uncommonly performed because of infrequent indication, misconceptions about it among patients and physicians, and reported morbidity, among other possible reasons. Morbidity as a factor was confirmed in our study: 77% of our patients experienced at least 1 perioperative complication. The most common was flap necrosis, which occurred in 5 patients (38%) and required a total of 9 reoperations.

Reported morbidity rates for flap necrosis range from an already immoderate 15% in high-volume centres³ to as much as 80% elsewhere.⁴ Necrosis often requires operative debridement and tissue coverage, which not only consumes nursing and other surgical and hospital resources but also may delay these patients' rehabilitation.

Two factors may have contributed

Table 1

Characteristics & Disease Status of 13 Patients Who Had a Hemipelvectomy (HP) at Foothills Hospital, mid-1983 to mid-2001

Age, yr	Type of tumour	Previous surgical procedures	Type of HP	Other, adjuvant procedures	Morbidity	Pathology at margins	Disease status	Site(s) of recurrence
36	Malignant fibrous histiocytoma	TAH-BSO	External	Sacrectomy (S2–S5); vaginectomy	Flap necrosis, ileus	neg	NED 9 mo after HP	—
58	Chondrosarcoma	—	External	—	Cellulitis	neg	NED 11 mo	—
18	Ewings' sarcoma	—	Internal	—	—	neg	NED 9 yr	—
48	Osteosarcoma	—	Internal, AG, THA	TRAM flap procedure	Flap necrosis, hip dislocation, osteomyelitis	neg	NED 9 yr	—
25	Liposarcoma	—	Internal, AG	—	Wound infection, bladder fistula, osteomyelitis	neg	Died of other causes, 5 yr	—
60	Chondrosarcoma	—	External	Sacrectomy (S3–S5)	Flap necrosis	pos	Alive with disease, 12 mo	Local
30	Schwannoma	Enucleation	External	—	—	pos	DOD 5 mo	Sarcomatosis
40	SCC of the vulva	Vulvectomy; 2 groin lymph-node dissections	External	Oophorectomy	Flap necrosis	neg	Alive with disease, 11 mo	Contralateral groin
29	SCC of the cervix	TAH-BSO; partial sacrectomy; abdominoperineal resection	External	Colectomy; transverse process of L5; L3–S1 nerve roots	Pneumonia	pos	DOD 20 mo	Carcinomatosis; liver
39	SCC of the vulva	Vulvectomy; bilateral lymph-node dissection	External	Partial cystectomy	—	neg	DOD 9 mo	Contralateral groin
66	SCC from undetermined primary site	—	Internal, AG, THA	TRAM flap procedure	Urinary retention	neg	DOD 8 mo	Liver & spine metastasis
56	Adenocarcinoma of the ovary	TAH-BSO; resection of buttock & pelvic side wall	External	Partial sacrectomy	Flap necrosis	pos	Died of other causes, 4 mo	—
37	SCC of the cervix	TAH-BSO	External	Abdominoperineal & small bowel resections	Intra-abdominal abscess; bowel obstruction	pos	Perioperative death, 49 d	—

AG = allograft; DOD = died of disease; NED = no evidence of disease at last follow-up; neg = negative; pos = positive; SCC = squamous cell carcinoma; TAH-BSO = total abdominal hysterectomy with bilateral salpingectomy and oophorectomy; THA = total hip arthroplasty; TRAM = transverse rectus abdominis myocutaneous

to flap necrosis. First, 9 patients previously had radiation therapy, which is known to compromise skin-flap viability. Second, 3 patients had simultaneous sacral resections (all 3 developed flap necrosis). Survival of the posterior skin-flap can depend on the viability of the underlying gluteus maximus muscle,⁵ which receives its medial blood supply from the sacrum. In 2 of these patients who had simultaneous posterior-flap HP and sacrectomy the sacral resection may have contributed to flap necrosis. The other sacrectomy was an anterior-flap HP based on the branches of the deep profunda femoral vessels. One perioperative death (8% mortality) occurred in a patient after a combined HP and pelvic exenteration, which is consistent with other reports in the literature.¹

The clinical indications for HP in this cohort of patients was remarkably different from those in other reports. Seven of 13 (54%) had sarcomas of the pelvis, the most common indication for HP. The other 6 HPs (46%) were performed for carcinomas (non-sarcomas) of the pelvis. Five of these were primary malignancies of the female genital tract; the other was a squamous cell carcinoma with an unknown primary source. There have been only a few reports of aggressive treatment of genital-tract malignancies involving the bony pelvis. Vulvar cancer has been treated by hip disarticulation⁶ and resection of the pubic bone,⁷ with only 1 case documented of the use of HP to treat cervical cancer.⁸ Our study of HPs is unique, with its high prevalence of cancers of the genital tract.

The long-term prognosis was dependent on the clinical indication for surgery, with better survival among patients with sarcomas (86% disease-specific survival, with a median follow-up of 12 months; the patient who died from sarcomatosis had a malignant schwannoma previously enucleated). Although the follow-up for our patients is heretofore limited, a favourable outcome in pelvic sarcomas

is not unexpected. Kawai and colleagues⁹ reported a 5-year survival in patients with primary bony sarcomas of the pelvis of 55%; with chondrosarcoma, 55%; Ewing's sarcoma, 52%; and osteosarcoma, 47%. Inadequate margins in combination with HP worsens the prognosis. The outcome among patients with soft-tissue sarcomas (2 in our study) requiring HP is worse, with a reported 5-year survival of only 10%.¹⁰

The 6 patients who underwent HP for pelvic carcinomas did poorly, with a median survival of 9 months. The sole patient with metastatic squamous-cell carcinoma from an unknown primary died of diffuse metastatic disease 8 months after HP. The other 5 had genital-tract malignancies; 1 died in the perioperative period. Three of the patients with genital-tract malignancy had disease progression: 1 developed carcinomatosis after incomplete excision of a cervical cancer, and 2 patients with vulvar cancer had recurrences in the contralateral groin. The fifth patient died of unknown causes 4 months postoperatively.

Reports of patients undergoing resection of the bony pelvis for locally advanced genital-tract malignancies are few. King and coworkers⁷ reported on 12 patients with primary and recurrent vulvovaginal cancers that required resection of the pubic bone as part of a radical resection. In their cohort 6 patients with a primary presentation of advanced vulvar cancer survived (as of 6–18 years of follow-up), but the other 6 died after a median follow-up period of 12 months. Pathologic exams of lymph nodes for all surviving patients had negative results; for all those who died, positive. King's group reported 1 patient with a recurrent vulvar cancer who survived, but not the length of survival.

Other groups have reported recurrence in the regional lymph nodes to be an independent factor for poor prognosis.^{11,12} One study¹¹ found no disease-free survival, and a 2-year median survival in patients with re-

currences in the regional nodal basin. The 2 such patients in our study were treated for large, fungating regional nodal recurrences, with 1 having undergone 2 previous ipsilateral groin dissections. Both had recurrences in the contralateral groin rather than locally, suggesting the presence of aggressive disease.

Only 1 article in the literature reports on a patient undergoing resection of the pelvis for cervical cancer. Wanebo and colleagues⁸ performed an external HP for recurrent cancer; their patient died of disease 14 months later. The 2 patients with cervical cancer in our study had locally advanced, recurrent disease. One required a pelvic exenteration in addition to HP; the other had resection of colon, a portion of the fifth lumbar vertebrae and surrounding nerve roots after a previous exenteration and sacral resection. Tissue margins for both patients displayed positive pathology. One died in the perioperative period, and the other died of metastatic disease.

The fifth genital-tract malignancy was a 12-cm ovarian cancer, treated with HP and partial sacrectomy after a previous wide excision of a recurrence involving the pelvic side-wall and gluteal muscles. No reports of similar cases could be found in the literature.

Performing an HP for the treatment of pelvic sarcomas is justified, given the prognosis of this disease. On the other hand, survival in patients with non-sarcoma carcinomas of the pelvis was poor, with no survivors beyond 20 months. This result is less surprising given the poor prognostic factors for each of these 6 patients. All had recurrent disease, with the 5 patients with genital-tract cancers requiring a composite resection and the 1 with an unknown primary having metastatic disease.

A major rationale for these 6 surgeries was local control of disease. Each of these patients had significant tumour burden, and all had received at least 1 previous course of external beam radiotherapy, leaving few other

reasonable options. The goal of their HPs was complete surgical resection, guided by preoperative imaging; unfortunately the margins of 3 of the 6 patients with cancer were pathologically positive. Most of these patients died of progressive disease, but none of their recurrences was local. Thus HP in this cohort of patients with highly advanced pelvic carcinomas provided good short-term local control, but was not curative.

Palliative HP has been advocated in other studies of patients with locally advanced or metastatic bone disease.^{2,10,13} Indications include intractable pain, ulceration, hemorrhage, infection and unstable pathologic fractures. In our group of patients with pelvic cancers, all 6 were having significant pain, 3 had objective leg weakness and 2 had fungating groin masses (1 of which was bleeding from the femoral vessels). Improvement in functional status and even quality of life after major amputation have been reported.¹³ Because of the retrospective nature of this study and follow-up at outside institutions, it is difficult to assess the degree of symptom control, palliation and quality of life achieved. Performing HP with a palliative intent is controversial, especially with less than a year's expected survival. All other treatment options should therefore be exhausted before considering HP, particularly analgesia for control of pain, the most common indication for HP.

In conclusion, hemipelvectomy is

a viable and potentially curative operation in patients with advanced sarcomas of the pelvis. In this small cohort of patients with locally advanced pelvic carcinomas (mostly of the genital tract), HP provided local control of disease but was not curative and prone to rapid nonlocal disease progression and death. Future improvements in imaging techniques and other treatment modalities might help in selecting patients in whom cure or long-term survival may be achieved. For patients in whom a cure is not expected, prospective quality-of-life studies are required to validate HP as a treatment option. At this time, its role in recurrent carcinoma remains to be determined.

Competing interests: None declared.

References

1. Apffelstaedt JP, Driscoll DL, Spellman JE, Velez AF, Gibbs JF, Karakousis CP. Complications and outcome of external hemipelvectomy in the management of pelvic tumors. *Ann Surg Oncol* 1996;3:304-9.
2. Malawer MM, Buch RG, Thomson WE, Sugarbaker PH. Major amputations done with palliative intent in the treatment of local bony complications associated with advanced cancer. *J Surg Oncol* 1991;47:121-30.
3. Karakousis CP, Emrich LJ, Driscoll DL. Variants of hemipelvectomy and their complications. *Am J Surg* 1989;158:279-82.
4. Cáceres E, Leon L. How I do it: modified hemipelvectomy. *J Surg Oncol* 1999;71:66-7. Commentary by CP Karakousis, 67-8.
5. Kulaylat MN, Froix A, Karakousis CP. Blood supply of hemipelvectomy flaps. *Arch Surg* 2001;136:828-31.
6. Powell JL, Donovan JT, Reed WP. Hip disarticulation for recurrent vulvar cancer in the groin. *Gynecol Oncol* 1992;47:110-3.
7. King LA, Downey GO, Savage JE, Twigg LB, Oakley GJ, Prem KA. Resection of the pubic bone as an adjunct to management of primary, recurrent, and metastatic pelvic malignancies. *Obstet Gynecol* 1989;73:1022-6.
8. Wanebo HJ, Whitehill R, Gaker D, Wang GJ, Morgan R, Constable W. Composite pelvic resection. *Arch Surg* 1987;122:1401-6.
9. Kawai A, Healey JH, Boland PJ, Lin PP, Huvos AG, Meyers PA. Prognostic factors for patients with sarcomas of the pelvic bones. *Cancer* 1998;82:851-9.
10. Apffelstaedt JP, Zhang PJ, Driscoll DL, Karakousis CP. Various types of hemipelvectomy for soft tissue sarcomas: complications, survival and prognostic factors. *Surg Oncol* 1995;4:217-22.
11. Hopkins MP, Reid GC, Morley GW. The surgical management of recurrent squamous cell carcinoma of the vulva. *Obstet Gynecol* 1990;75:1001-5.
12. Piura B, Masotina A, Murdoch J, Lopes A, Morgan P, Monaghan J. Recurrent squamous cell carcinoma of the vulva: a study of 73 cases. *Gynecol Oncol* 1993;48:189-95.
13. Merimsky O, Kollender Y, Inbar M, Chaitchik S, Meller I. Palliative major amputation and quality of life in cancer patients. *Acta Oncol (Madr)* 1997;36:151-7.